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U.S. PATENT APPLICATION

Title: **VIRTUAL ENGINEER**

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U.S. PATENT APPLICATION

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VIRTUAL ENGINEER

BACKGROUND

The following invention relates to a method and system for providing engineering support services and, in particular to a method and system for remotely diagnosing and resolving a technical problem associated with a product or service.

Customers of technically sophisticated products and services often require technical support to properly use the product or service. For example, to implement Shipley's ultrafill copper electrolyte electroplating process requires specific engineering expertise. Thus, sellers of technical products and services typically make available engineers and technicians to respond to requests for technical support from their customers. For some support requests, the engineer can determine the underlying problem and implement a resolution remotely, for example through a telephone call with the customer. In many cases, however, in order to properly service the customer, the engineer must observe the problem first hand because the customer is not sufficiently skilled in identifying and describing the symptoms of the problem. In such cases, the engineer must either go to the customer's location or, if feasible, have the product in question shipped to the engineer so that the engineer can correctly diagnose and repair the problem. In either case, however, because qualified engineers are costly to train and maintain, the cost of providing competent technical support is high and is often reflected in increased product costs. More typically, the service provider is not able to staff sufficient qualified engineers which results in inefficient and slow customer support, especially if on-site service is required.

Accordingly, it is desirable to provide a system and method for providing engineering and technical support services to remotely diagnose and resolve a technical problem associated with a technical product or service.

SUMMARY OF THE INVENTION

The present invention is directed to overcoming the drawbacks of the prior art. Under the present invention a method and system is provided for diagnosing a fault and includes a decision tree having a plurality of decision points wherein at least some of the plurality of decision points terminate in a resolution point representing a diagnosis for the fault. Also included is a plurality of queries each having at least a first response and a second response where each of the plurality of queries being associated with one of the plurality of decision points. The system also includes a knowledge base that includes a plurality of first images where each of the plurality of first images illustrate one of the first responses. A user interface is included for presenting the plurality of queries and the illustrative first images to a user. The user navigates the decision tree by responding to at least some of the plurality of queries by viewing the illustrative first images and basing a selection between the first response and the second response associated with said at least some of said queries on said illustrative first images. Finally, the fault is diagnosed when the user navigates the decision tree until the resolution point is reached.

In an exemplary embodiment, the knowledge base includes a plurality of second images where each of the plurality of second images illustrate one of the second responses wherein the user interface presents the illustrative second images to the user so that the user may respond to the at least some of the plurality of queries by viewing the illustrative second images.

In another exemplary embodiment, the knowledge base includes a diagnostic image illustrating the diagnosis of the fault and when the user reaches the resolution point, the user interface presents the diagnostic image to said user.

In yet another exemplary embodiment, the knowledge base includes a resolution of the fault and when the user reaches the resolution point, the user interface presents the resolution to the user.

Accordingly, a user may access the system of the present invention to diagnose and resolve a technical problem associated with a technical product or service by responding to the queries presented to the user by the system with the aid of images that assist the user in identifying the symptoms associated with the technical problem. Once the user responds to all the queries presented by the system, the user is presented with an image of the diagnosed problem, thereby confirming the diagnosis, and a resolution to the technical problem. Thus remote diagnostic and remedial services for technical and engineering problems is provided.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts that will be exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims. Other features and advantages of the invention will be apparent from the description, the drawings and the claims.

DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is block diagram of a system for providing remote diagnostic and remedial services in accordance with the present invention;

FIG. 2 is a drawing of a decision tree for diagnosing faults that is included in the system of FIG. 1;

FIG. 3 is a screenshot of an image depicting a rim void;

FIG. 4 is a screenshot of an image depicting a resist plug void; and

FIG. 5 is a screenshot displaying the likely causes for resist plug voids and recommended remedial actions.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Referring now to FIG. 1, there is shown a system 1 for providing remote diagnostic and remedial services in accordance with the present invention. System 1 includes a knowledge base 3 that stores diagnostic and remedial information. Also included in system 1 is a decision tree module 5 that is in communication with knowledge base 3 and that is used to present the information contained in knowledge base 3 in a diagnostically useful format. In an alternative embodiment, knowledge base 3 and decision tree module 5 are integrated. System 1 also includes a user interface module 7 for providing a user 9 with access to decision tree module 5 and knowledge base 3 of system 1. User 9 may access system 1 using, for example, a personal computer that communicates with system 1 via the Internet according to techniques well known in the art.

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Referring now to FIG. 2, there is shown a decision tree 11 that is contained in decision tree module 5 that is used to diagnose a particular fault. Decision tree 11 is made up of a plurality of decision points D(2), D(4), D(6), D(8), D(10), D(20) and D(30), as well as a plurality of resolution points R(12), R(14), R(16), R(18), R(22), R(24), R(26) and R(28). Each of decision points D have associated therewith a query designed to identify a symptom of the fault thereby leading to an eventual diagnosis. Each query has associated therewith a number of potential responses to the query from which user 9 may choose where each of the responses identifies a possible symptom of the fault. In order to guide user 9 in identifying the correct symptoms and thus choosing the appropriate response, an image illustrating each of the

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symptoms associated with the responses is retrieved from knowledge base 3 and displayed to user 9. By comparing the visual symptoms of the fault to be diagnosed to the images associated with each response, user 9 is aided in identifying the symptoms of the fault and selecting the correct response to the query. Thus, by navigating decision tree 11 to a resolution point R with the guidance of illustrative images, a diagnosis of the fault can be made without necessarily requiring an engineer to observe the fault first hand.

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For example, if user 9 is using system 1 to diagnose a defective circuit board, then the query associated with decision point D(30) may be directed to determining what type of void defect the circuit board has. Associated with the query of decision point D(30) are two potential responses -- a rim void or a resist plug void -- from which user 9 may select as a response to the query. Displayed to user 9 are images 1 and 3, shown in FIGS. 3 and 4, respectively, that are stored in knowledge base 3 and which illustrate to user 9 the appearance of a rim void and a resist plug void, respectively. By comparing the defective circuit board to images 1 and 3, user 9 can more accurately determine which type of void defect has caused the circuit board to fail. Based on the comparison, user 9 will either navigate decision tree 11 to resolution point R(24) or R(26) at which point the type of defect causing the circuit board to fail will have been uniquely identified as either a rim void or a resist plug void.

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Thus, decision tree 11 is constructed so that once navigation of decision tree 11 reaches a resolution point, sufficient symptoms have been provided to uniquely identify the fault. In addition, upon reaching a resolution point, a diagnostic image illustrating the fault is retrieved from knowledge base 3 and displayed to user 9 so that user 9 can visually confirm that the diagnosis is correct. Also retrieved from knowledge base 3 and provided to user 9 is information describing the likely causes of the diagnosed fault as well as the resolution of the fault. For

example, if navigation of decision tree 11 resulted in a diagnosis that a resist plug void was the cause of board failure, then displayed to user 9, as shown in FIG. 5, are the likely causes for resist plug voids and recommended remedial actions. Accordingly, by navigating decision tree 11 and reaching a resolution point, user 9 is presented with a diagnosis of the fault in question, a diagnostic image illustrating the fault, likely causes of the fault and recommended remedial actions.

Sub A5 The diagnostic information may be presented to user 9 in any suitable manner in which user 9 can reach a resolution of the fault to be diagnosed. For example, decision tree 11 may be constructed to include decision points having queries with more than two possible responses from which to choose with an image illustrating each response. Also, in certain situations where the diagnosis of the fault is complex, user 9 may be required to traverse several decision points to reach a resolution point and thus determine the cause and remedy of the fault. In addition, system 1 may present to user 9 all the resolution points and allow user 9 to compare the fault to be diagnosed to the illustrative images associated with each of the resolution points so that user 9 can directly diagnose the fault without having to respond to queries for traversing decision tree 11. The diagnostic information contained in knowledge base 3 may similarly be arranged and presented to user 9 in any manner that enables user 9 to diagnose the fault in question.

Accordingly, a system and method is provided to remotely diagnose and resolve a technical problem associated with a product or service. By using the system and product of the present invention, remote diagnosis and remediation is provided while eliminating, or greatly reducing, the need for technical personnel to actively participate in the technical support process.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in

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